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Vitamin K and Bone Health

Preliminary evidence suggests that people may need more vitamin K than the current Recommended Dietary Allowance to maintain strong, healthy bones. The vitamin activates at least three proteins involved in bone formation. One of them, osteocalcin, needs to be saturated with chemical structures known as carboxyl groups. And the attachment of these carboxyl groups requires vitamin K.

Earlier this year, French scientists found that older women with elevated blood levels of the undersaturated protein had lower bone density and a higher risk of hip fracture. So ARS researchers conducted a pilot study, using their newly developed blood test, to see if extra vitamin K could increase saturation, thereby improving the outlook for bone health. It did. When nine healthy, young men and women consumed four times the RDA for vitamin K, their levels of the undersaturated protein were significantly lower than when they consumed the RDA. They also excreted less of the carboxyl groups, indicating that more were being added to protein.

The vitamin is well known for its role in blood clotting, and the current RDA—around 85 to 95 micrograms (mcg) per day—is based on the requirement for normal clotting. People can increase their vitamin K intake by adding one or two servings of spinach, kale, collard greens or broccoli to their daily diet—provided they get some fat at the same meal so the vitamin will be absorbed.

For more information, contact James A. Sadowski or Sarah Booth, (617) 556-3150, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA; e-mail: sadowski_vk@hnrc.tufts.edu; or Lori J. Sokoll, (410) 955-6304, Division of Clinical Chemistry, Johns Hopkins Medical Institutions, Baltimore, MD; e-mail: lsokoll@welchlink.welch.jhu.edu.

Researchers at the ARS center have also improved chemical methods for measuring the vitamin K content of different types of foods. They then expanded their database of vitamin K levels by analyzing more than 250 foods collected nationwide by the Food and Drug Administration for its Total Diet Study. Using these data, they estimated the vitamin K intake by 14 age and gender groups, based on the FDA model of typical consumption. With the exception

of 25- to 30-year-old men and women, most Americans get the vitamin K daily Recommended Dietary Allowance of about 85 micrograms—that's millionths of a gram.

The richest sources of vitamin K are green, leafy vegetables. One serving of spinach or collards, for instance, or two servings of broccoli provide four to five times the RDA. The greener the vegetable, the higher the content, say the researchers, because the vitamin is associated with the chlorophyll. Vegetable oils—soybean, canola and olive—and dressings containing them are the second best source. Animal foods are poor sources unless they are cooked, processed or packaged with one of these oils—but not corn and peanut oil, which are much lower in vitamin K.

For more information, contact James A. Sadowski or Sarah Booth, (617) 556-3150, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA; e-mail: sadowski_vk@hnrc.tufts.edu.

Bee-Gone

A spray that would immediately repel attacking bees, including Africanized honey bees, should result from a cooperative agreement with Consep, Inc., of Bend, OR. Small canisters of a safe, nontoxic, pleasant smelling bee repellent could be handy protection for letter carriers, meter readers, utility and construction workers, campers and others. The bee spray being investigated by ARS scientists has as its major ingredient a mimic of a natural repellent that queen bees produce to keep worker bees out of their way. Africanized bees invaded the United States a few years ago via Mexico. They now are found in Arizona, California, New Mexico and Texas.

For more information, the ARS contact is Eric H. Erickson, (520) 670-6380, Carl Hayden Bee Research Center, Tucson, AZ; e-mail: ehejr@ccit.arizona.edu.

A Shot of Milk For New Premies

Premature infants who receive small amounts of breast milk or formula within days of birth—in addition to intravenous feedings—may get a much-needed boost in intestinal development. This may enable them to more quickly tolerate

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regular feedings, a prerequisite for release from the hospital. Preliminary findings, based on the progress of 70 premature infants weighing less than 2.5 pounds at birth, indicate that early feedings stimulate production of lactase. That's the enzyme that digests the major milk sugar, lactose.

For years, very low birth weight infants have received intravenous (IV) feedings exclusively for the first two weeks. Because these infants didn't produce the enzyme, doctors thought the undigested sugar from breast milk or formula would increase the risk of necrotizing enterocolitis—a serious complication that destroys the intestinal lining. But this ongoing study strongly suggests that the advantages of early feedings outweigh the disadvantages.

Half the infants were introduced to less than one-quarter cup of breast milk or formula each day beginning only four days after birth. The other half received only IV feedings for two weeks. A test administered three times during their first month showed that the early feeding group had significantly higher lactase activity for the first three weeks.

For more information, contact Robert Shulman, (713) 798-7145, Childrens Nutrition Research Center, Houston, TX; no e-mail address.

Friendlier Food Tables

It's now possible to take in 5,600 foods at one sitting without gaining a pound. Just download the new USDA Nutrient Database for Standard Reference (SR11) from the Internet or the laboratory's bulletin board. It's free of charge. This eleventh release of the food composition tables lists values for more than 70 food components—such as vitamins, minerals, lipids, amino acids, fiber and energy (calories)—in over 5,600 foods grouped into 22 categories. It replaces SR10, issued three years ago, as well as the printed publication—USDA Handbook No. 8.

The nutrient database is a major source of food composition data for epidemiological researchers as well as food and nutrition professionals, and serves as the foundation for most commercial nutrient database programs. In the latest version, laboratory nutritionists have added new food items, such as ethnic foods, brand name candies and infant formulas and foods. There are also updated values for breakfast cereals, new sodium values for canned vegetables and soups, and new data for beef and lamb cuts with external fat trimmed to 1/8 inch, reflecting recent market changes.

SR11 is more user friendly than older versions because of its new relational format. Users with relational database management software—such as Paradox, Access, or Dbase—can retrieve information and generate their own reports. On the Internet, SR11 can be retrieved from the Nutrient Data Laboratory Home Page: <http://www.nal.usda.gov/fnic/foodcomp>. Staffers have also added a search tool for locating the nutrient values of selected foods. Those without an Internet connection can retrieve the database from the Nutrient Data Laboratory Bulletin Board by dialing (301) 734-5078. This version does not have

a search tool, however. A CD-ROM of the database will be available sometime next year.

For more information, contact David Haytowitz or Susan Gebhardt, (301) 734-8491, Beltsville Human Nutrition Research Center, Beltsville, MD; e-mail: ndlinfo@rbhnrc.usda.gov.

Natural Insect Control for Stored Grain

A natural fungus could be a new weapon against insects that infest stored grain, replacing chemical insecticides. *Beauveria bassiana* had a success rate of 80 to 100 percent in killing invading insects in preliminary lab tests. Insecticides are now growers' main recourse, but some registrations are scheduled to be withdrawn. ARS scientists envision *Beauveria* as a potential alternative against rice weevils, lesser grain borers and red flour beetles. These insects—primarily during their immature, wormlike stage—can ruin stored rice, corn, wheat and sorghum. The fungus kills the adult insects within two to four weeks after infecting them. But it doesn't grow on the stored grain and is harmless to humans and animals.

Scientists caution further research is needed, particularly to find how *Beauveria* can be formulated. Ideally, it could be deployed to squelch the first infestation of adult insects. This would greatly reduce numbers of a succeeding generation of wormlike offspring.

For more information, contact William Rice, (318) 788-7553, Rice Research Unit, Beaumont, TX; e-mail: wrice@lsuvm.sncc.lsu.edu

New Trim from Trash and More

A new no-calorie, high-fiber fat replacer could soon find a place in foods ranging from cheese products and hamburger to baked goods. Developed by an ARS researcher, Z-Trim is made from low-cost agricultural byproducts such as hulls of oats, soybeans, peas and rice, or bran from corn or wheat. The hulls or bran are processed into microscopic fragments and purified, then dried and milled into an easy-flowing powder. When the powder absorbs water, it swells to form a gel that provides foods with an enjoyable smooth texture.

For more information, contact George E. Inglett, (309) 681-6363, National Center for Agricultural Utilization Research, Peoria, IL; e-mail: inglettge@ncaur1.ncaur.gov.

Oatrim retains its health benefits equally through baking or boiling. That's based on a test of its ability to reduce blood glucose, thereby reducing the risk of middle-age diabetes. Twenty-four men and women had as much improvement in their glucose tolerance after consuming baked or boiled pudding containing Oatrim as they did with instant pudding. Oatrim can't be fried, however. The ARS-developed fat replacer contains beta glucans, a fiber

component that lowers cholesterol, and is now found in many processed foods.

In an earlier long-term study, Oatrim significantly reduced volunteers' cholesterol, blood pressure, glucose and the hormones controlling glucose tolerance. And the volunteers lost weight, despite efforts to prevent weight loss. The researchers wanted to know if the cooking method altered Oatrim's efficacy. Judging from the glucose responses of these volunteers, it made little difference. Total dietary fiber was slightly higher in uncooked Oatrim, and it produced a bigger response in one of the hormones that control blood glucose. But there was no difference between the cooked puddings.

For more information, contact Judith Hallfrisch, (301) 504-8396, Beltsville Human Nutrition Research Center, Beltsville, MD; e-mail: hallfris@asrr.arsusda.gov.

Phantoms of the Lab

Skeletons made of epoxy resin are helping researchers at the Children's Nutrition Research Center in Houston improve the accuracy of bone mineral content measurements in growing children. A dual-energy x-ray absorptiometer, or DXA, is becoming a common tool for measuring bone, fat and lean mass in people because of its precision and ease of use. Others using the DXA have reported a loss of bone mineral content in volunteers who have lost weight. The Houston researchers wondered if this was an actual loss or if the DXA was "seeing" more bone mineral when the subjects had more fat in their bodies. So they filled the skeletons with predetermined amounts of calcium to approximate the content in children and adolescents at ages 4, 10, 15 and 18.

With each section of the skeleton encased in plastic cylinders, these "phantoms" resemble distant cousins of the Tin Man in *The Wizard of Oz*. But they answered the question. Their calcium content, as measured by the DXA, agreed closely with the actual amount of calcium added. When they were made 15 to 20 percent heavier, by laying strips of a fat-simulating material over the abdomen, hips and thighs, the DXA measured a small but significant increase in calcium content—about 2.5 percent more.

The correction will enable researchers to more accurately gauge the true rate of bone growth in children. And they plan to use the epoxy phantoms to calibrate other equipment for measuring minerals in the human body, such as the whole body counter and neutron activator.

For more information, contact Kenneth J. Ellis or Roman J. Shypailo, (713) 798-7000, Children's Nutrition Research Center, Houston, TX; e-mail: kellis@bcm.tmc.edu; shypailo@bcm.tmc.edu.

Meat Doesn't Boost Stored Iron

Iron levels did not increase in postmenopausal women when they ate several servings of meat and poultry daily for seven weeks. That's good news because epidemiological

studies have associated excess iron in the body with increased risk of cardiovascular disease. It is thought that having too much iron—as measured by serum ferritin—raises the chance that free iron ions will be available to damage blood vessels and other tissues. Young women regularly lose iron through the menstrual flow. But women past menopause and men tend to accumulate the mineral unless they regularly donate blood. Results of this study indicated that eating meat for seven weeks had little effect on iron stores.

During the five-month study, the 14 women consumed three different diets: high-meat, low-meat and low-meat with mineral supplements to supply missing nutrients. The extra protein in the high-meat diet did not reduce the women's calcium status, as suggested by some research. They did not excrete more calcium or experience a drop in body calcium levels or bone metabolism, which corroborates other findings and indicates that calcium status cannot be used as a rationale for eating less meat. Lastly, the high-meat diet improved the women's zinc absorption. They absorbed more zinc from the high-meat diet than they did from the low-meat diet, even when supplemented with zinc.

For more information, contact Janet Hunt, (701) 795-8328, Grand Forks Human Nutrition Research Center, Grand Forks, ND; e-mail: jhunt@gfhnrc.ars.usda.gov.

Fresher Foods

A new process that keeps prepeeled potatoes from turning brown for up to two weeks could replace sulfite treatment, thanks to a cooperative agreement with EPL Technologies, Inc., Conshohocken, PA, to commercialize the process. Prepeeled potatoes, widely used by food processors and the food service industry, rapidly brown if not treated with browning inhibitors. Sulfite, the most effective antibrowning compound for potato products, leaves a residue in food that can trigger an allergic reaction in some consumers.

Under the new ARS-EPL process, scientists treat prepeeled potatoes in a heated solution containing FDA-approved food additives, and then apply a different sulfite substitute without heating. The combined treatments maintain quality and shelf life of the product for two weeks without adversely affecting product texture. Current sulfite substitutes forestall potato browning for only one week and often induce textural defects.

For more information, the ARS contact is Gerald M. Sapers, (215) 233-6417, Eastern Regional Research Center, Wyndmoor, PA; e-mail: gsapers@arserrc.gov.

New coatings that can extend the shelf life of grapefruit for up to two months are expected from a cooperative research and development agreement with Ecogen, Inc., Langhorne, MA, and Mantrose-Haueser, Attleboro, MA. The coatings will contain an ARS-patented natural yeast that protects grapefruit from postharvest diseases. Unno-

ticeable on treated fruit, the coatings can be applied at the packinghouse to prevent green mold, which feeds on nutrients on the fruit's surface. The protective yeast thrives on the same nutrients, so it crowds out the fruit-damaging mold, making it an ideal candidate for a biocontrol product.

For more information, the ARS contact is Raymond G. McGuire, (305) 238-9321, Subtropical Horticulture Research Station, Miami, FL; no e-mail address.

Loaves That Almost Float

Better breads and other baked goods for tomorrow may result from ARS scientists' success with gene-engineered wheat kernels. The scientists are the first to boost the amount of bread-making proteins—known as high molecular weight glutenins—in wheat kernels. Breadmakers already know that flour high in these proteins yields light, fine-textured loaves. Researchers increased the amount of the proteins as much as 50 percent in bioengineered wheat grown in the greenhouse. So far, six successive generations of the plants retained this trait. Sometime next year, the scientists expect to have enough flour from experimental plants to bake test loaves. One tool they used in the work is a genetic on-and-off switch called a promoter. It might work equally well to ratchet up—or down—other key proteins in wheat kernels. This, in turn, might lead to additional gene engineering of wheat to yield an array of unique new flours or innovative by-products for industrial uses.

For more information, contact Ann E. Blechl, (510) 559-5716, Western Regional Research Center, Albany, CA; e-mail: ablechl@pw.usda.gov.

Stomach Acid Aids Carotene Absorption

Stomach acid apparently plays an important role in the absorption of beta carotene and other carotenoids recognized for their antioxidant activity in the body. That's according to the results of a study reported in the current issue of the *American Journal of Clinical Nutrition* (vol. 64, pp. 622-626). A group of 12 men and women took a drug, omeprazole, for nine days to temporarily block the production of stomach acid. Then they took a 120-milligram beta carotene supplement. Their blood levels of beta carotene

rose only half as much, compared to their beta carotene levels when they took the supplement without taking the drug.

This helps explain why—in a nutritional status survey of elderly conducted in the early 1980's by this ARS center—the lowest levels of carotenoids were seen in participants who had lost the ability to secrete stomach acid. About 30 percent of people over age 60 have this condition, known as atrophic gastritis or hypochlorhydria. The researchers suspect that long-term infection with *Helicobacter pylori*, the bacteria that causes stomach ulcers, contributes to the destruction of acid-secreting cells. They theorize that eating more sour foods may increase carotenoid absorption, but have not yet done such tests. Normally, stomach acidity is around a pH of 1. The omeprazole drug raised the study volunteers' stomach pH to between 4.6 and 7.4.

For more information, contact Guangwen Tang, (617) 556-3133, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA; e-mail: tang_hp@hnrc.tufts.edu.

Ouchless Vitamin A Test

Today's method for checking the body's supply of vitamin A might be replaced within a few years by a simple, fast and easy blood test that ARS researchers are now developing. When ready, the blood test would make the current technique—a liver biopsy—unnecessary. Researchers have newly paired two laboratory techniques—supercritical fluid extraction and reversed phase liquid chromatography—to more accurately measure vitamin A supplies in liver samples. Their analyses should quicken their search for a compound in blood that would give an equally accurate reading.

Liver biopsies, though painful, are currently used for vitamin A tests because that is where the body keeps its largest reserves of this vitamin. The blood test that the researchers envision could be used by physicians and other healthcare professionals to check their patients' vitamin A stores. And it might be used in the national health and nutrition surveys, co-sponsored by USDA, that are a key source of new information for evaluating and fine-tuning the nation's Recommended Dietary Allowances—or RDA's—for essential nutrients such as vitamin A. According to current USDA estimates, about 55 percent of all Americans receive less than the RDA for vitamin A.

For more information, contact Betty J. Burri, (415) 556-6285, Western Human Nutrition Research Center, San Francisco, CA; no e-mail address.

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